TITLE: **VACUUM EXCAVATION SUCTION HOSE**

ATTACHMENT

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FIELD OF THE INVENTION

This invention relates to a hose attachment and, more particularly, to a vacuum excavation suction hose attachment.

DESCRIPTION OF RELATED ART

It is known in the art to use multiple hoses with vacuum systems in order to apply various fluids to the area being vacuumed in order to aid in debris removal.

Hughes et al. (US 4,517,404) discloses one such system using one hose connected to a vacuum and a second hose used to spray a solution such as soap or water in order to create an emulsion with the dirt in the rug.

One problem arising from the conventional art is when the debris being vacuumed has a wide range of size, the vacuum hose can become clogged from the larger particles.

Another problem arising from the conventional art is the spray nozzle attachment can increase the overall size of the vacuum hose system, and may prevent access to smaller areas.

SUMMARY OF THE INVENTION

In order to overcome the problems of the prior art, the present invention provides a vacuum hose assembly comprising a vacuum hose, or conduit. A second hose is attached along the outside surface of the vacuum hose and attaches to a spray nozzle.

In accordance with one embodiment of the invention, the spray nozzle is housed within an indention on the outside surface of the suction end of the vacuum conduit. The indention reduces the size of the opening in the suction end, and thus affects the velocity of air and debris travel and limits the maximum debris size entering the vacuum hose.

In another embodiment, an enlarged bell shaped portion defines the suction end of the vacuum conduit. The spray nozzle is housed within an indention on the outside surface of the bell shaped portion.

In another embodiment, multiple spray nozzles are housed within multiple indentions in the suction end of the vacuum conduit.

In another embodiment, the spray nozzle is supported within the bell shaped portion by an aerodynamic support.

In another embodiment, the vacuum hose has an inward rolled edge on the suction end.

Numerous other embodiments are also possible. These elements of the embodiments described herein can also be combined in other ways, or with other elements to create still further embodiments.

BRIEF DESCRIPTION of the DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which may be regarded as forming the present invention, it is believed that the invention will better understood from the following description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a cross section side elevation view of a vacuum hose according to the invention.

Fig. 2 is an end view of the suction end of the vacuum hose shown in Fig. 1.

Fig. 3 is an end view of the suction end of the vacuum hose with multiple indentions.

Fig. 4 is a cross section side view of a vacuum conduit showing the entrance edge of the hose circumference being rolled inward.

Fig. 5 illustrates using the vacuum hose in conjunction with a vacuum debris tank.

Fig. 6a is a cross section side view of a jetter nozzle located within the vacuum hose.

Fig. 6b is an end view of a jetter nozzle located within the vacuum hose.

DESCRIPTION OF THE PREFERED EMBODIMENTS

Referring now to the drawings, Fig. 1 is a cross section side elevation of a vacuum hose 17 which may be used to vacuum excavated dirt or earthen material. The circumference wall 79 of the vacuum hose 17 has been increased at the suction inlet to form a bell 91 shaped configuration. The bell circumference 91 is larger than the vacuum hose circumference 79 thus increasing the inlet area. An indention 92 is made into the bell circumference 91. The ratio between the vacuum hose circumference 79, the bell circumference 91 and the size of the indention 92, affects the area of the suction inlet of the vacuum hose 17 thus affecting the velocity of air and debris travel at that point. Various desired velocity characteristics may be achieved by manipulating the above mentioned ratios. Various debris 45 are vacuumed more effectively at different velocities thus the above mentioned ratios may be predetermined for best efficiency of a given debris 45 to be vacuumed.

The indention 92 may be sized so as to restrict the maximum size of debris 45 which may enter the vacuum hose 17 thus not allowing debris 45 to enter the vacuum hose 17 which would be so large as to clog the vacuum hose 17.

A liquid spray nozzle 82 which may be a pulse jet, a rotary jet, a jetter nozzle or a fixed spray jet may be placed in the indention 92. The indention 92 may be cone shaped so as to direct the nozzle 82 orifice 76 and liquid spray 3 in the direction of the center of the area to be vacuumed by the vacuum hose 17, thus the liquid spray 3 effectively loosens and makes vacuumable the dirt at the entrance of the suction end of the vacuum hose 17. The spray 3 also is used to emulsify the complete area of the area to be

vacuumed equal to or greater than the effective area or freeboard of the vacuum end 79 of the conduit.

Liquid is supplied to the nozzle 82 by means of the spray nozzle hose 58.

Fig. 2 is an end view of the suction end of the vacuum hose showing how the bell circumference 91 is indented 92 in order to restrict the debris 45 size entering the hose to less than the size of the vacuum hose circumference 79.

Fig. 3 is similar to Fig. 2 except that it illustrates that multiple indentions 92 and nozzles 82 may be placed around the vacuum hose circumference 79. Various arrangements of the multiple nozzles 82 may be used, such as all three nozzles 82 laying parallel with the vacuum conduit, or all three nozzles 82 aimed towards the center of the area to be vacuumed or each nozzle 82 tilted a predetermined angle along the circumference 79 in order to create a vortex to further help in loosening debris.

Fig. 4 is a cross section side view of a vacuum conduit 17 showing the entrance edge of the hose circumference 79 being rolled inward 93 in order to reduce the area of the hose entrance to less than the area of the hose 17, thus increasing the travel velocity of air and debris 45 entering the suction end of the hose 17. The inward rolled edge 93 of the vacuum hose circumference 79 limits the maximum diameter and area size rocks and other debris 45 to less than the diameter and area of the vacuum hose 17. The above mentioned inward rolled edge 93 reduces the occurrence of debris clogging the vacuum hose 17.

Fig. 5 illustrates that the above described vacuum hose 17 suction end improvements may be used in conjunction with a vacuum debris tank 12 which serves as temporary storage for the debris 45 vacuumed into it through the vacuum hose 17. Water

may be pumped from a water tank 8 through a hose 58 to the spray nozzle 82 in order to make dirt and other earthen material vacuumable.

Figs. 6A and 6B illustrate the use of a jetter nozzle 93 located within the vacuum hose 17 and near the suction entrance of the same. An aerodynamic support 94 holds the nozzle in place and also serves as a means to convey liquid from the sprayer hose 58 to the nozzle 93. The jetter nozzle has one or more orifices 76 directed at the debris 45 to be made vacuumable and also has water jet orifices directed up the vacuum hose 17 in order to aid in moving the debris through the vacuum hose 17 without clogging.

While particular embodiments of the invention have been shown, it will be understood, of course, that the invention is not limited thereto since modifications may be made by those skilled in the art, particularly in light of the foregoing teachings. Reasonable variation and modification are possible within the scope of the foregoing disclosure of the invention without departing from the spirit of the invention.